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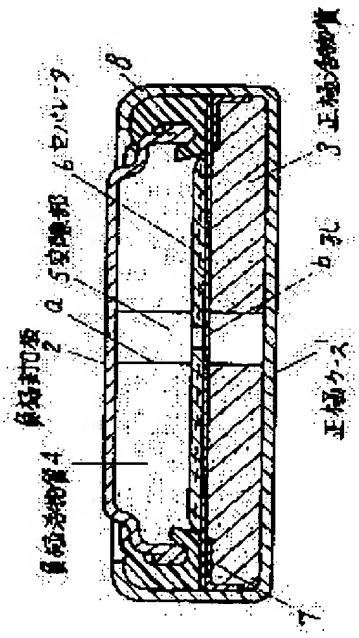
(54) ENCLOSED BATTERY

(57)Abstract:

PURPOSE: To make the enclosing of a button battery possible by providing respective air gaps in a positive electrode and a negative electrode, sandwitching a hole which is perforated in the central portion of a separator.

CONSTITUTION: The size of air gaps of the central portion in a positive electrode and a negative electrode is set to the size which is larger than the diameter of a hole b which is perforated in a separator 6. Oxygen gas generated from the positive electrode 3 in overcharging passes through the hole b and is reacted and absorbed at the end of the air gaps 5 in the negative electrode 4. By this cycle of the generation of oxygen - the absorption in the negative electrode, a constant internal pressure is maintained and can withstand to the overcharging.



Whereby, it is possible to restrain the rise of the internal pressure due to the gas and to enclose a button battery.

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⑤4発明の名称　密閉電池

⑳特　願　昭60-56808
㉒出　願　昭60(1985)3月20日

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明　細　書

1、発明の名称

密閉電池

2、特許請求の範囲

(1) 電池ケースと封口板およびこの両者間に介在する封口リングによって発電要素を密封した密封した電池であって、前記発電要素中セパレータの中央部に孔をあけ、かつこの孔をはさんで正負極に空隙部を設けたことを特徴とする密閉電池。

(2) セパレータ中央部の孔径が、正負極の空隙孔径より小さい特許請求の範囲第1項記載の密閉電池。

3、発明の詳細な説明

産業上の利用分野

本発明は、密閉電池に関するものである。

従来の技術

最近の電子機器の発展に伴い、電源として小型の高性能電池が要求されるようになってきた。しかも、その用途も電卓，時計などのように単一仕

様ではなく、太陽電池との組み合せによるいわばボタン電池の二次電池的な使われ方をするようになってきた。

ところが、現在使用されているボタン電池の構造では二次電池として使用するには、いろいろな問題がある。

特に、過充電時のガス発生に伴う内圧の上昇がある。円筒型の密閉電池では、セパレータを介して正負極は渦巻き状に巻かれており、常に正負極の端面が露出している。

又、極板の充填容量も正極より負極を多くするように設計されている。従って、電池容量は正極で規制され、過充電時は、正極より酸素ガスが発生する。この酸素ガスは負極活物質に吸収され、このサイクルがくり返されるため、一定の圧力を維持することが可能となる。しかし現行のボタン電池では、このメカニズムを使用できない。

発明が解決しようとする問題点

このメカニズムを利用するためには、正極より発生する酸素ガスを負極側に迅速に吸収させる必

要がある。現行のボタン電池の構成では、酸素ガスの円滑な負極への移行がセパレータによって遮断され、電池内圧の上昇が著しく、ついにはハレツを起こすことになる。

これを押えるために、充電が完了して一定の電圧になると充電のための電流が流れなくなる様な充電回路を作り内圧上昇を押えるような方法が考えられたが、コスト的な面から実用化に困難が伴う。

本発明は、このような問題を解決するもので、ボタン電池の密閉化を可能とし、二次電池への展開をはかることを目的とするものである。

問題点を解決するための手段

本発明は、セパレータの中央部に孔をあけ、かつこの孔をはさんで正負極にそれぞれ空隙部を設けたものである。

作　用

このような本発明の構成によって、過充電時に正極より発生する酸素ガスは、セパレータ中央部の孔を通って負極側に達し、孔に臨む負極端面と反応して、充電→ガス発生→負極面での吸収がくり返され、ガスによる内圧の上昇が押えられ、ボタン電池の密封化がはかれるものである。

実施例

第１図は、本発明の実施例によるボタン型ニッケルーカドミウム電池（直径11.6 mm高さ5.4mm）の断面図であり、１は正極ケース、２は負極封口板である。３，４は正負極の活物質で水酸化ニッケル，水酸化カドミウムを使用しており、これらは１，２に接触している。またその中心部にはそれぞれ空隙部５を設けて形状的にはドーナツ状となっている。この時の正負極の理論充填比は１対２とし、負極の容量を大きくしている。６はセパレータで正負極間に介在し、かつその中心に通気孔としての孔ｂを備えている。

この孔ｂの大きさは、酸素ガスが透過させうるに足るものでよく、ここでは直径0.3mmとした。又、正負極中心部の空隙部５の大きさは、セパレータにあけた孔ｂの直径より大きくしなければならない。空隙部５の内径を孔ｂの直径と同等もし

くは小さくすると内部ショートを起こす原因となる。セパレータ６の孔ｂに対して１～２mm大きくするのが最も好ましく、ここでは1.6mmとした。過充電時に正極３より発生した酸素ガスは、セパレータ６の孔ｂを通って、負極４の空隙部５の端面ａで反応し、吸収される。この酸素発生ー負極での吸収のサイクルによって一定の内圧が維持され過充電に耐えられるようになる。７は正極ケース１と正極活物質３との密着性を向上させるための正極リング、８は封口リングである。なお電解液には濃度３０重量%のか性カリに水酸化リチウムを溶解させたものを用いた。

又、負極側に溶解性電極、例えば亜鉛電極を用いると、過充電時に樹枝状亜鉛が析出するためにニッケルーカドミウム電池のようなセパレータ（含液材を兼ねている）では、すぐに内部ショートを起こす。従って、含液材の他に強度の強いセパレータを設ける必要がある。そのため、酸素の通過が著しく押えられる。その結果、酸素吸収反応は進みにくく、電池内圧の上昇は著しいものが

ある。

本発明の構成によって前述の現象は起こらず、過充電にも耐え得ることが可能となった。

次に本発明による構成(A)と従来の構成(B)とについて、１mA で完全充電し、その充電終了後更に充電を続けた（過充電時）の電池内圧の挙動を第２図に示した。その結果、従来の構成(B)ではほぼ直線的に電池内圧の上昇が認められた。これは過充電時に発生した酸素ガスがスムーズに負極側に吸収されないためである。一方、本発明の構成(A)では、２kg／cm²までは直線的な上昇は認められるが、それ以後の内圧の上昇は極めて緩和される。２kg／cm²までの上昇は、負極側が酸素と反応するために必要な圧力であり、それ以降は酸素ガスの円滑な移行があるためである。

発明の効果

このように本発明の密閉電池では過充電しても内圧の上昇は認められず、簡易な充電回路でも十分充電可能であり、トータル的にみても極めて安価な二次電池としての密閉電池を提供できる。

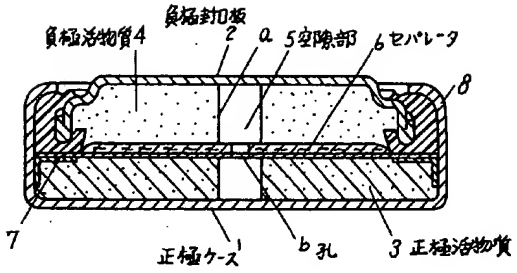
4、図面の簡単な説明

第1図は本発明の一実施例によるボタン形密閉電池の断面図、第2図は充電時間と電池内圧との関係を示す図である。

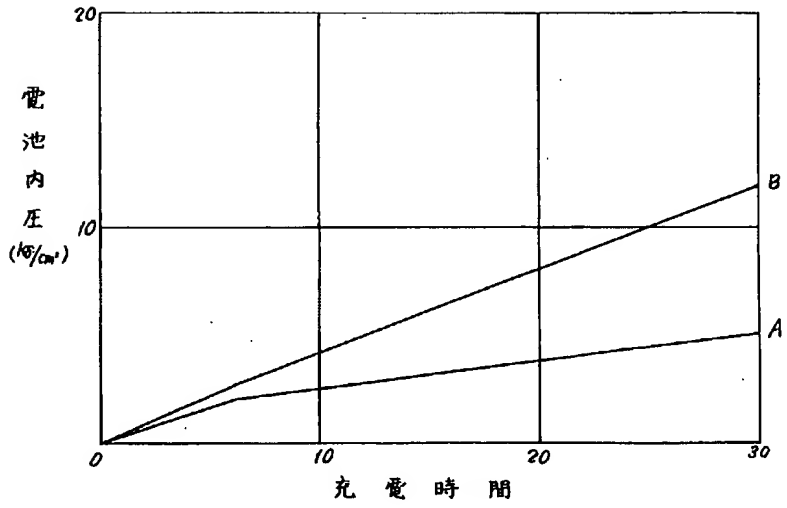
1……正極ケース、2……負極封口板、3……正極活物質、4……負極活物質、5……空隙部、6……セパレータ、7……正極リング、8……封口リング、b……孔。

代理人の氏名　弁理士　中　尾　敏　男　ほか1名

第　1　図



第　2　図



PTO 02-4875

Japanese Kokai Patent Application
No. Sho 61[1986]-216269

ENCLOSED BATTERY

Takao Yokoyama, et al.

UNITED STATES PATENT AND TRADEMARK OFFICE
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ENCLOSED BATTERY

[Mippei denchi]

Inventor:	Takao Yokoyama, et al.
Applicant:	Matsushita Electric Industrial Co., Ltd.

[There are no amendments to this patent.]

Claims

1. A type of enclosed battery characterized by the following facts: the enclosed battery has the power generating elements enclosed by means of a battery case, a sealing plate, and a sealing ring included between said two parts; among said power generating elements, the separator has a hole formed in its central portion, and a void portion is formed in each of the positive electrode and negative electrode that have said hole sandwiched between them.

2. The enclosed battery described in Claim 1 characterized by the fact that the diameter of the hole at the central portion of the separator is smaller than the diameter of the void holes of the positive electrode and negative electrode.

Detailed explanation of the invention

Industrial application field

This invention pertains to a type of enclosed battery.

Prior art

Recently, with development in electronic equipment, there has been a need for development of small-size high-performance battery as the power source. In addition to applications in calculators, watches, etc., the button battery may also be used as a rechargeable battery in combination with a solar battery.

However, when the button battery with the conventional structure is used as a rechargeable battery, there are various problems.

In particular, in company cylindrically-shaped with generation of gas in case of overcharging, the internal pressure rises. In a cylindrically-shaped enclosed battery, a positive electrode and a negative electrode are set with a separator between them and are wound up in a roll, and the end surfaces of the positive electrode and negative electrode are exposed.

Also, as far as the filling capacity of the electrode plates is concerned, the filling capacity of the negative electrode is larger than that of the positive electrode. Consequently, the battery capacity is defined by the positive electrode, and, in case of overcharging, oxygen gas is generated from the positive electrode. The oxygen gas is absorbed by the negative electrode active substance. As this cycle is carried out repeatedly, it is possible to maintain a steady pressure. However, for the current button battery, this mechanism cannot be used.

Problems to be solved by the invention

In order to make use of this mechanism, it is necessary for the oxygen gas generated by the positive electrode to be absorbed quickly by the negative electrode. For the constitution of the current button battery, smooth migration of oxygen gas to the negative electrode is cut off by the separator, so that the internal pressure of the battery rises significantly. Finally, the battery is damaged.

In order to solve these problems, the following method has been proposed: a charging circuit is formed such that no current for charging flows when charging comes to an end and a prescribed voltage is reached, so as to suppress rise in the internal pressure. However, this method can hardly be used in practical application due to problems related to the cost.

The objective of this invention is to solve the aforementioned problems of the conventional methods by providing a type of enclosed battery characterized by the fact that as it allows enclosing of the battery, the battery can be used as a rechargeable battery.

Means to solve the problems

According to this invention, a hole is formed in the central portion of the separator, and void portions are formed in the positive electrode and negative electrode that have said hole sandwiched between them.

Operation of the invention

In the constitution of this invention, the oxygen gas generated from the positive electrode in case of overcharging goes through the hole at the central portion of the separator to reach the negative electrode side. Then, the oxygen gas reacts with the end surface of the negative electrode facing the hole. As a result, the cycle of charging → gas generation → absorption on the negative electrode surface is carried out repeatedly, rise in the internal pressure due to the generated gas is suppressed, and the enclosed state of the button battery is maintained.

Application examples

Figure 1 is a cross-sectional view of a button type nickel-cadmium battery in an application example of this invention (with diameter of 11.6 mm and height of 5.4 mm). (1) represents a positive electrode case; (2) represents a negative electrode sealing plate; and (3) and (4) represent active substances of the positive electrode and negative electrode made of nickel hydroxide and cadmium hydroxide, respectively. These active substances are in contact with (1) and (2). Also, void portion (5) is formed at the central portion of each of them so that they are in a donut shape. In this case, the ratio of theoretical filling of positive electrode to negative electrode is 1:2, with the capacity of the negative electrode larger than that of the positive electrode. (6) represents a separator included between the positive electrode and negative electrode. It has hole (b) as gas permeating hole at its center.

The size of said hole (b) should be sufficient to let the oxygen gas pass. In this example, the diameter of this hole is 0.3 mm. Also, the size of void portions (5) at the centers of positive electrode and negative electrode should be larger than the diameter of hole (b) on the separator. If the inner diameter of void portions (5) is equal to or smaller than the diameter of hole (b), internal short circuit takes place. The inner diameter of the void portions is preferably larger than the diameter of hole (b) of separator (6) by 1-2 mm (1.5 mm in this example). The oxygen gas generated from positive electrode (3) in case of overcharging goes through hole (b) of separator (6), and it reacts with end surface (a) of void portion (5) of negative electrode (4) and is absorbed there. Due to the cycle of oxygen generation - absorption at negative electrode, a steady internal pressure is maintained, and it becomes possible to withstand overcharging. (7) represents a positive electrode ring for improving the adhesiveness between positive electrode case (1) and

positive electrode active substance (3), and (8) represents a sealing ring. The electrolyte is prepared by dissolving lithium hydroxide in 30 wt% [solution] of caustic potassium.

Also, for example, when a zinc electrode is used as the soluble electrode on the side of the negative electrode, branch-shaped zinc is deposited in case of overcharging. Consequently, internal short circuit takes place for the separator (also acting as liquid-impregnated material) of a nickel-cadmium battery. Consequently, it is necessary to set a high-strength separator in addition to the liquid-impregnated material. Consequently, passage of oxygen is suppressed significantly. As a result, oxygen absorption reaction hardly can take place, and the internal pressure of the battery rises significantly.

According to the constitution of this invention, the aforementioned phenomenon does not take place, and it can withstand overcharging.

Figure 2 is a diagram illustrating the behavior of the internal pressure of the battery when further charging is carried out (overcharging) after end of complete charging at 1 mA for constitution (A) of this invention and conventional constitution (B). From the results, it can be seen that for conventional constitution (B), there is a nearly linear rise in the internal pressure of the battery. This is because oxygen gas generated in overcharging is not absorbed smoothly by the negative electrode. On the other hand, in constitution (A) of this invention, the internal pressure rises linearly to 2 kg/cm^2. After reaching 2 kg/cm^2, rise in internal pressure becomes rather mild. Rise of the internal pressure to 2 kg/cm^2 is [necessary] for realizing the pressure needed for reaction between oxygen gas and the negative electrode. After that, oxygen gas migrates smoothly.

Effect of the invention

As explained above, for the enclosed battery of this invention, even in case of overcharging, there is no rise in the internal pressure. Sufficient charging can be realized using a simple charging circuit, and an overall inexpensive rechargeable battery can be provided as an enclosed battery.

Brief description of the figures

Figure 1 is a cross-sectional view of a button type battery in an application example of this invention. Figure 2 is a diagram illustrating the relationship between the charging time and the internal pressure of the battery.

1 Positive electrode case
2 Negative electrode sealing plate
3 Positive electrode active substance

4 Negative electrode active substance
5 Void portion
6 Separator
7 Positive electrode ring
8 Sealing ring
b Hole

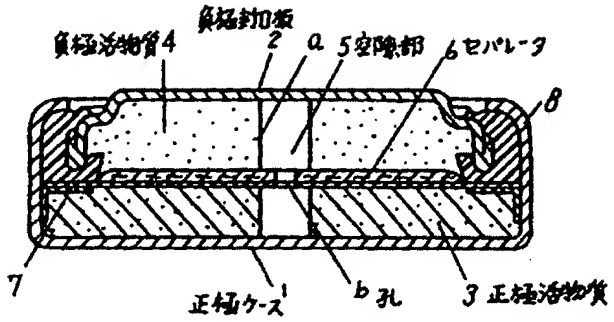

Figure 1

Key: b Hole
1 Positive electrode case
2 Negative electrode sealing plate
3 Positive electrode active substance
4 Negative electrode active substance
5 Void portion
6 Separator
8 Sealing ring

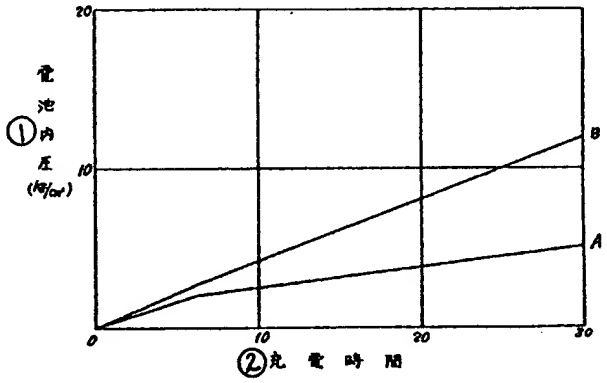

Figure 2

Key: 1 Internal pressure of battery (kg/cm^2)
2 Charging time